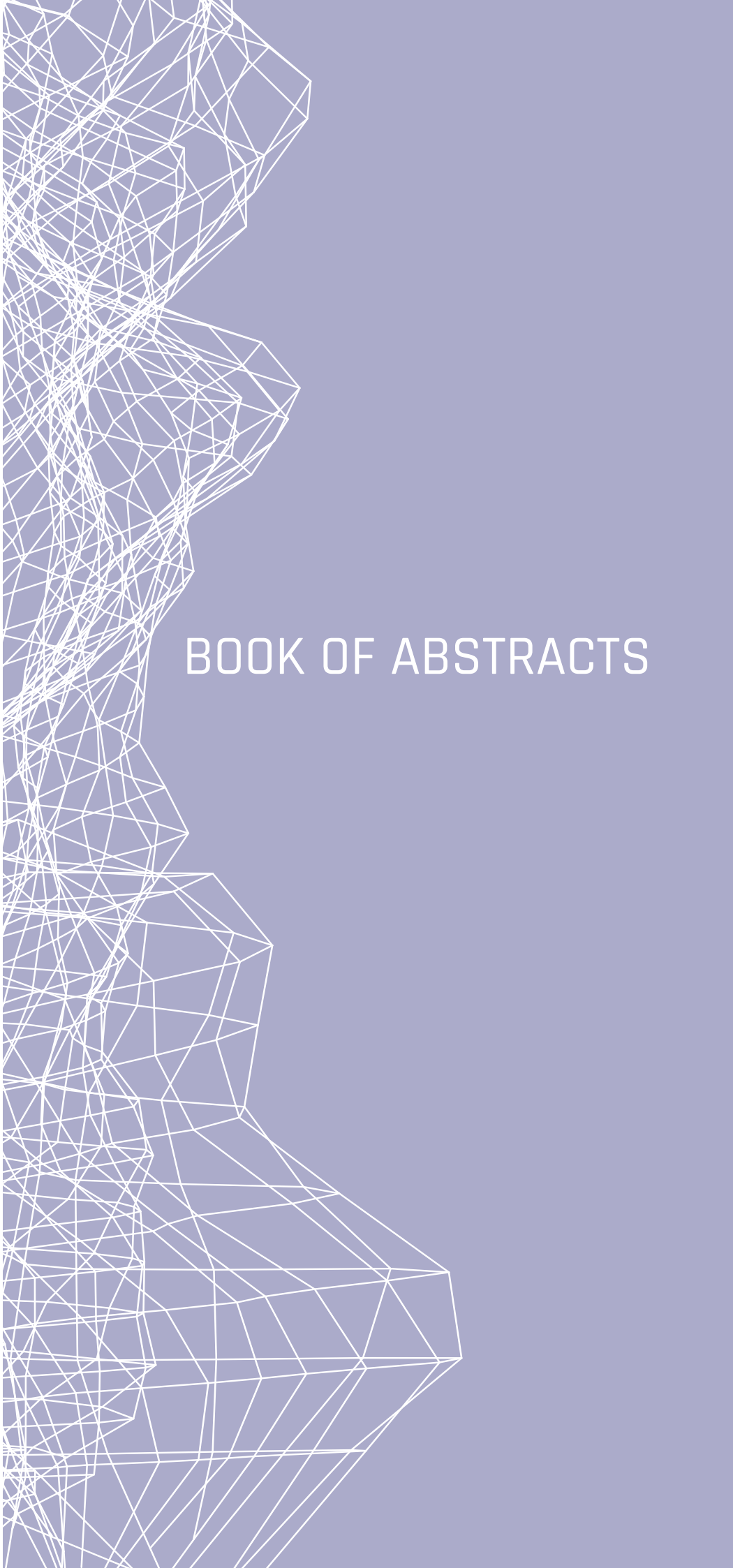
The dark side of high tech precious materials recovery. Overview on the critical issues, opportunities and best practices from a material library point of view

RSD7 2018

RELATING SYSTEMS THINKING AND DESIGN 7th SYMPOSIUM

CHALLENGING COMPLEXITY BY SYSTEMIC DESIGN TOWARDS SUSTAINABILITY

TURIN
23-28.10.2018



BOOK OF ABSTRACTS

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EDITORIAL

The seventh *Relating Systems Thinking and Design (RSD7) symposium* was held at the Politecnico di Torino, the 23-28 October 2018, for the first time in Italy, defining an important collaboration among the institutions that founded the informal group of Systemic Design Research Network (SDRN) in 2012. Not by chance, this symposium has seen the official establishment of the Systemic Design Association (SDA), with a public announcement during the first day. A new phase of the association and of the RSD symposiums started by proposing an inclusive approach to expand the membership and engage different systems- and design-oriented professionals and researchers, while looking after a strong identity of systemic design as a discipline.

The proceedings show the huge amount of contributions we received from all over the world that have inspired more than 200 people in Turin. The aim was to promote international debate on the multiple applications and purposes on which the systems thinking in design is developed towards sustainability. The symposium generated nurturing interdisciplinary collaborations and discussions, involving academics, designers and professionals. *"Challenging complexity by Systemic Design towards sustainability"* was the leitmotive of all RSD7 starting from the workshops, through the keynotes, the plenaries and the parallel speeches, and closing with the de-conference at Monviso Institute.

Four workshops were organized by international experts, coming from *Smart Circular Economy Network*, *University of Brighton*, *Ellen Mac Arthur Foundation*, *Namahn center* and *ShiftN*. Around 100 attendees had a full day workshop in which they investigated the theme of complexity, declined through different areas: IoT, material/immaterial places, Circular Economy and Systemic Design. At the end of the the day, the workshops' results were shown in a plenary session and discussed all together with a breaking ice kick-off.

From 24th to 26th October, we had the proper symposium with 6 inspiring keynote speakers, 3 plenary sessions, and 76 presentations in the parallels sessions. We evidenced all the contents through abstracts, presentations and working papers, as well as videos and sketch-notes.

The RSD7 keynotes offered an inspiring range of perspectives on systemic design, emerging from different disciplines and experiences from all over the world. They brightly explained how Systemic Design can effectively integrate systems thinking with design to address complexity, by creating new resilient and sustainable systems in very diverse contexts. We decided to interview them and provide to the whole community a short video to have a glance of their contribution.

The plenary speakers were invited to explore special themes of interest for the community: the newborn Systemic Design Association, the pioneering activities run by Ellen Mac Arthur Foundation and the stimulating Systemic Design Toolkit.

The presentations in parallel sessions were dense and reflected the tracks we proposed. Here we have condensed the wide variety of contributions:

- **Policy design and decision-making** (Innovation in territorial governance, Strategies for sustainable innovation, Design thinking for decision-making, Democracy and responsibility);
- **Industrial Processes and Agrifood Systems** (Industrial ecology in a Circular Economy, Sustainable innovation in industrial development, Sustainabili-

ty of agro-industrial systems);
- **Socio-technical Systems in the Digital Age** (User interaction and enhancement in the age of AI and autonomy, Internet of Things for sustainability, Information technologies in the design domain, Systemic Design for learning from data);
- **Territorial Metabolism and flourishing economies** (Local resources innovation transitioning to a Circular Economy, Sustainable development of regions and bioregions, City metabolism and urban ecologies, Interdisciplinary models for economy-design, New ways of communicating economic systems)
- **Social Care and Health Systems for Sustainable Living** (Sustainable innovation for health systems, Patient empowerment and caregiving, Systemic innovation in social care, Social Flourishing & Cultural Sustainability);
- **Models and Processes of Systemic Design** (Systemic Design theories, Innovation processes in complex systems, Systems and design thinking in education, Historical perspectives on Systemic Design).

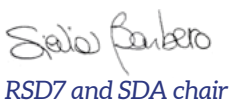
The process to select the best presentations was crucial and it required double (and in some case triple or more) reviews, trying to provide a wider spectrum of experiences. In the end, the success rate was 48%. About two third of the presenters have submitted working papers.

The conference was also enriched by the exhibition "Visualizing Complex Systems". The ability to collect, cross-check, visualize and study quantitative and qualitative information about phenomena and their patterns is itself at the core of the project, becoming strategic for enabling new systems thinking and their design application. Identifying the relationship between components, thus guaranteeing personal expression, horizontal communication and visual thinking, is the first step to enhance a more conscious and transparent decision-making process with a perspective of sustainability.

During the 7th edition of RSD we also experienced some moments of relaxed "learning-and-doing time", during the "Books and Beers" events and the De Conference Event. In fact, at the end of each day, 3 decompressing "Books and Beers" were hosted in the close venue of Eataly. On that occasion, 5 recently published books were introduced to the audience and discussed in a more informal environment.

After the conventional RSD symposium, for the first time in its history, we proposed a 2-days De-Conference event, to favour networking, deepen conference topics and have a relaxed "learning-and-doing" time in a beautiful natural environment. It took place at MonViso Institute, in the community of Ostana, and it was organised in collaboration with ETH Zürich.

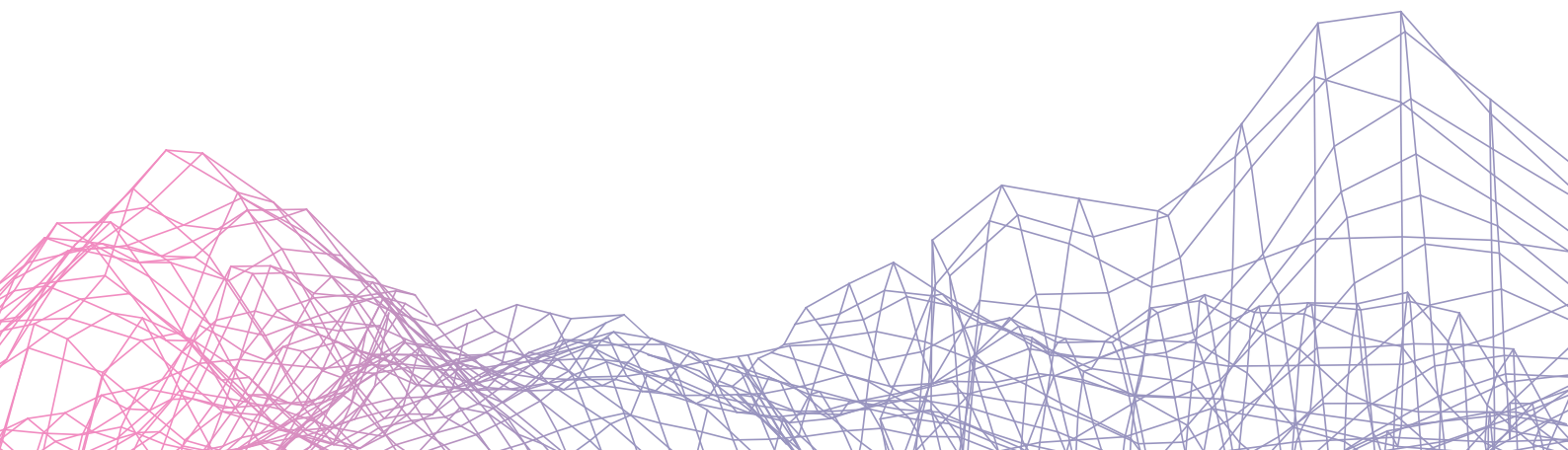
Lastly, I would like to take the chance of this publication to thank the international scientific committee because in the preparation phase they always pushed me towards higher and higher goals. A special thank goes to all the keynote speakers to have been central actors of this conference, sharing their inspiring experiences and knowledge. Finally, I would like to thank the local organizing committee because they supported me in every request and with great confidence in our capacity.



RSD7 and SDA chair

Turin, 29.03.19

2 | INDUSTRIAL PROCESSES AND AGRI-FOOD SYSTEMS



The dark side of high tech precious materials recovery.

Overview on the critical issues, opportunities and best practices from a material library point of view

Dal Palù Doriana,
Coraglia Valentina,
Lerma Beatrice
Politecnico di Torino
doriana.dalpalu@polito.it
valentina.coraglia@polito.it
beatrice.lerma@polito.it

KEYWORDS
Circular economy;
Environmental sustainable processes;
Ethics in design;
E-waste;
Recycled materials;
Precious and non-precious metals;
urban mining.

Eco-sustainable design strategies act as the liaison between different disciplines and professionals: the world of production and research, companies and the key issues of project development –economics, society and environment [Lerma, 2014]. Many of the environmental sustainability issues are either directly or indirectly linked to materials and their life cycle [Lindahl, Robèrt and Broman, 2014]. Environmental impacts occur at different stages of the life cycle, including the extraction, production, transportation and processing of raw materials, as at the stage when the product is actually used and disposed of [Vezzoli and Manzini, 2007]. Furthermore, a material can be considered eco-sustainable when it is effectively and efficiently used within a specific project and integrated into the entire application system. Moreover, it comes to environmental sustainability when opting for the use of materials and semi-finished products sourced from areas comparable to that where the company operates [Allione, De Giorgi, Lerma and Petruccelli, 2012]. Therefore, creating a network of contacts in the region able to assist manufacturing companies, particularly SMEs, when selecting their suppliers or researching and assessing local partners for processing operations appears as more and more necessary, but this approach cannot be always pursued.

Eco-sustainable design strategies play a role of utter importance for the development of innovative sustainable products and production processes [El-Haggar, 2007]. Specifically, in an evolving scenario of increasing dematerialization and greater complexity of objects, several specific materials already in production and those still being field tested, become more meaningful [Ferrara, 2004], such as those precious and not precious ones coming from the e-waste domain. The rapid expansion of technology and, what is more, the programmed obsolescence of these products, means that a very large amount of e-waste is created every year, every day, every minute [Baldé, Forti, Gray, Kuehr, and Stegmann, 2015].
Different materials are present in e-waste: the base metals include iron, copper, aluminium, nickel, zinc, selenium, indium, gallium and precious metals. Hazardous substances that can be found in e-waste include mercury, beryllium, lead, arsenic, cadmium and antimony instead. In addition, the larger material group consists of plastics, glass and ceramics [Fornalczyk, Willner, Francuz and Cebulski, 2013], adopted for the case and the outer part of the devices. The availability of these materials generated the new definition of "urban mining" as the activity of recovery materials from urban waste becoming "the mines of the future", and providing materials for reuse and cutting costs and landfill waste.

The recovery of metals and precious metals from electronic waste (e-waste) has been in fact an important topic not only for economic aspect but also for recycling rare natural sources and reducing the e-waste to prevent the environmental pollution, in other terms, following the 7Rs Golden Rule usually adopted for a sustainable waste management [El-Haggar, 2007]: in order to achieve the correct use and application of materials from a green perspective, eco-compatibility must in fact be considered when they are chosen as much as when they are at the end of their life.
Additionally, today's materials are smart and encase an inner core of performance and function that could previously only be given by complex systems. Other key elements that have to be taken into account regarding environmental sustainability are the players involved in the design and manufacturing processes, the origin of the resources and the location of the suppliers and manufacturers and the development of further production [Ceppa and Lerma, 2014].

One possible eco-sustainable approach towards the issue of e-waste is offered by Circular Economy [Geissdoerfer, Savaget, Bocken and Hultink, 2016] and the related System Design thinking [Barbero, 2016], suitable for dealing with industrial processes strategically, and aiming at recovery precious second life materials to new applications, both into the same productive chain, or to new ones. With this approach, thousands of electronic appliances (such as audio-visual components, televisions, VCRs, stereo equipment, mobile phones, other handheld devices, and computer components contain valuable elements and substances suitable for reclamation, including lead, silver, copper, and gold) are dismantled, and their materials are divided in order to be conveyed to new productive chains, new productive systems and new proactive industries. Nevertheless this procedure still doesn't avoid critical issues. As an example, this process entails social, environmental and legal questions, such as those generated by the uncontrolled movement of e-waste to countries where cheap labour and primitive approaches to recycling have resulted in health risks to local residents exposed to the release of toxins continues to an issue of concern [Ottaviani, 2018].

This investigation presents a panoramic overview, as well as the specific point of view of a material library on the topic. The aim will be showing the most recent data about the global amount of e-waste production, analysing the potentialities of innovation in terms of sustainable production and Circular Economy applied to the new application fields of these innovative - or renewed – materials in the Italian context; and showing how a material library can be valid support for the already existing SMEs, companies and designers in boosting this virtuous process. On the other hand, the most critical consequences of e-waste recovery are discussed and analysed, supported also by several case studies taken from the world of design and craftsmanship, dedicated to highlight this complex issue, showing how eco-sustainable design strategies can really trigger virtuous mechanisms of economic development.

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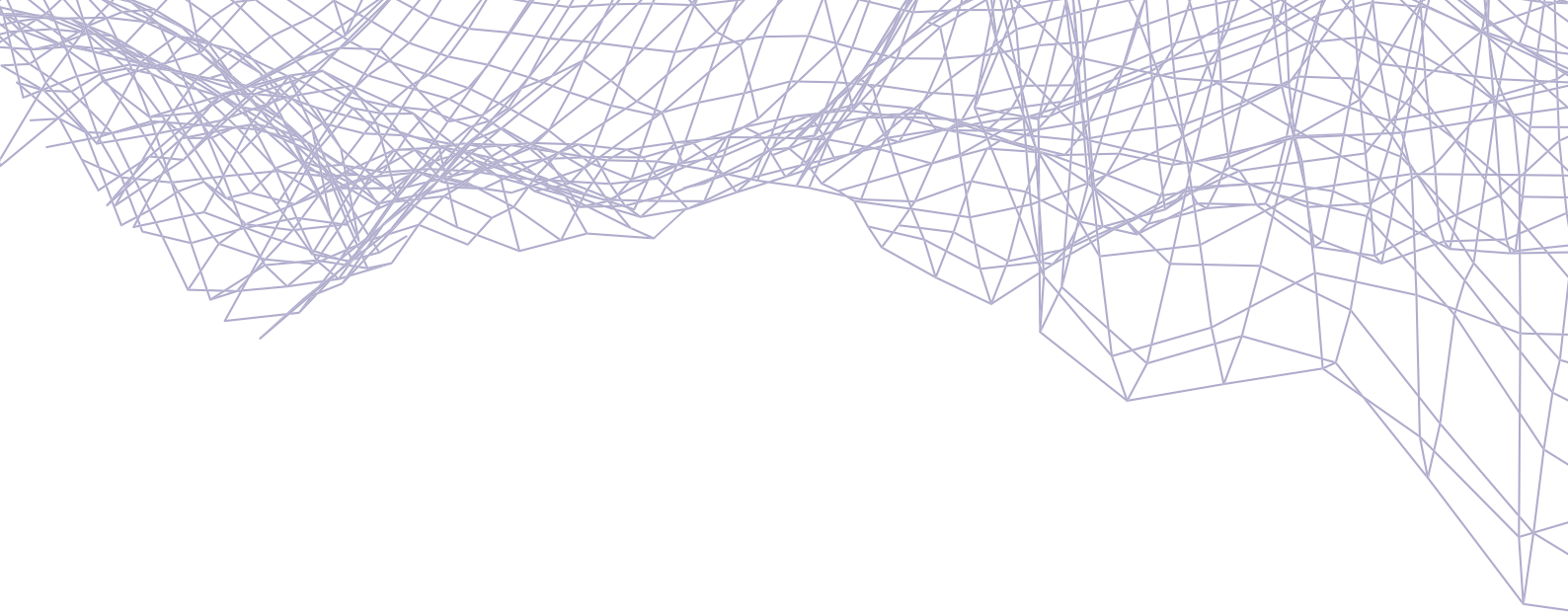

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